Education and Diversity (ED) in MMAP
Feeding the Pipe

• By middle school, if students aren’t interested in science, we’ve lost them ...

• Strengthen Earth System Science education at all levels
  - Content, curiosity, inquiry, real research
  - Teach new faculty how to teach

• Draw from the diversity of the whole population rather than only a portion
Integrated Education and Diversity

- Future Scientific Leaders
- Future Academic Leaders
- Partners
- Grad Institutions
- CSU Psych
- Grad Institutions
- "levelizers"
- Windows to the Universe
- Undergrad Institutions
- Undergrad Institutions
- SOARS
- CSU Sociology
- CO-AMP
- teacher training
- SEE-ME
- classroom evaluation
- assessment
- LSOP
- TV show
- Grades 5-8
- Grades 9-12
- Researchers
- Graduate
- Undergraduate
- Public Outreach
- Undergraduate Institutions
- Undergrad Institutions
- Partners
- Partners
- Partners
- Partners
- Partners
- Researchers
- Undergraduate Institutions
- Public Outreach
- Grades 9-12
- Grades 5-8
- teacher training
Education Mission

Educate and train a diverse population in climate and Earth System Science by enhancing teaching and learning at all educational levels, disseminating science results through multiple media, engaging stakeholders and policymakers, and improving science pedagogy.
Strategy for Education

• Provide opportunities for students at all levels to engage in active learning of Earth Science and Climate by experimentation.
• Work with successful and well-established partners in curriculum development, science communication, and multimedia for maximum impact.
• Intervene early to draw from the whole range of our diverse population.
• Link Education, Outreach, and Diversity elements of the Center, so leverage investments in all three.
Strategy for Education (cont'd)

- Structured mentoring interactions to bring science content to all levels, to help future educators learn to be better teachers, and to provide strong role models of a motivated, diverse population of young scientists.

- Provide opportunities for current and future leading scientists to learn to be better teachers, both formally (through pedagogical instruction) and informally (through mentoring).
Strategy for Education (cont’d)

• Combine curriculum development and implementation with classroom evaluation and formal assessment

• Maintain active communication across Center components through an EOD Committee, summer institutes, and twice-yearly meetings
Education Goals

- Enhance the climate science workforce of the future
- Enhance teaching and learning of Earth System Science at all levels
- Disseminate MMAP science results to the public and to climate stakeholders
## Education Objectives

<table>
<thead>
<tr>
<th>Objective</th>
<th>Action Steps</th>
<th>Responsible Person &amp; Team</th>
<th>Location</th>
<th>Time-frame</th>
</tr>
</thead>
<tbody>
<tr>
<td>Develop, implement, disseminate and evaluate improved Earth System</td>
<td>Develop and test curriculum enhancement kits for local schools</td>
<td>Jones</td>
<td>CSU</td>
<td>Ongoing</td>
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<tr>
<td>Science curricula for middle and junior high schools</td>
<td>Develop climate content for LSOP &amp; TV show</td>
<td>Jones, Denning</td>
<td>CSU, CSU</td>
<td>Ongoing</td>
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<td>Teacher training course</td>
<td></td>
<td>Jones, TIR</td>
<td>CSU, PSD, TVS</td>
<td>Ongoing</td>
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<tr>
<td>Evaluation/assessment</td>
<td></td>
<td>Lacy</td>
<td>CSU</td>
<td>Ongoing</td>
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<tr>
<td>Improved climate education at high school level</td>
<td>SEE-ME web-based modeling tools</td>
<td>Denning, Foster, ED coord</td>
<td>UCAR PSB Schools, CSU, Catamount Institute</td>
<td>Ongoing</td>
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<td></td>
<td>Teacher training course</td>
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<td></td>
<td>UCAR levelizers</td>
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<td></td>
<td>Classroom evaluation</td>
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<td></td>
<td>Formal assessment</td>
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<td></td>
<td>Climate summer program, Catamount</td>
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<tr>
<td>Dissemination of MMAP science to public via web</td>
<td>Windows to the Universe web site</td>
<td>Foster, Denning, ED coord</td>
<td>UCAR CSU</td>
<td>Ongoing</td>
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<td></td>
<td>Science communication analysis</td>
<td>Russell, Jones, Canetto</td>
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</table>
## Education Objectives (part 2)

<table>
<thead>
<tr>
<th>Objective</th>
<th>Action Steps</th>
<th>Responsible Person &amp; Team</th>
<th>Location</th>
<th>Time-frame</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outreach to climate stakeholders &amp; policymakers</td>
<td>Climate white papers for stakeholders</td>
<td>Kathlene Denning</td>
<td>CIPP UCAR</td>
<td>Ongoing</td>
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<td>Summer workshops</td>
<td>ED coord Foster</td>
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<td>Short course on policy for MMAP grad students</td>
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<tr>
<td>Improved undergraduate climate education</td>
<td>New climate courses</td>
<td>Denning Drossman</td>
<td>CC Regional institutions (CO-AMP)</td>
<td>Ongoing</td>
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<td></td>
<td>Minority recruiting and retention</td>
<td>ED coord</td>
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<td></td>
<td>El-Hakim</td>
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<tr>
<td>Graduate education and research</td>
<td>Recruiting excellent and diverse students</td>
<td>Denning MMAP faculty</td>
<td>All institutional partners</td>
<td>Ongoing</td>
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<td></td>
<td>Improved climate coursework</td>
<td>ED coord</td>
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<td>Direct involvement with research</td>
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<tr>
<td>Teaching future teachers</td>
<td>Teacher training course</td>
<td>Denning ED coord</td>
<td>CSU PSD Schools MMAP partners</td>
<td>Ongoing</td>
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<td></td>
<td>Mentoring interactions</td>
<td>Stevens</td>
<td></td>
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<td></td>
<td>LSOP internships</td>
<td>Jones</td>
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</tbody>
</table>
Obj 1: Middle School Curricula

- Future Scientific Leaders
- Future Academic Leaders
- Partners
- Collaborators
- CSU ATS
- CSU Psych
- SOARS
- CSU Physics
- Teacher training
- "levelizers"
- Classroom evaluation
- SEE-ME
- Windows to the Universe
- Undergraduate
- Graduate
- Researchers
- Public Outreach
- CO-AMP
- Undergraduate
- Grades 9-12
- Grades 5-8
- Teacher training
- Classroom teachers
- Curriculum enhancement kits
- LSOP
- TV show

- CSU Sociology
Little Shop of Physics
Brian Jones (CSU Dept. of Physics)
Sheila Ferguson and Karen Hammann Poudre School District
Hands-On School Programs: 1 Year=

• 50 schools / 15,000 K-12 students
• 150 CSU students
• Special emphasis on rural & underserved populations
On the Air: Everyday Science

• Poudre School District
• Rocky Mountain PBS
• DVD series
Teacher Workshops

- Current & Future Teachers
- 200+ Teachers Yearly
- International Connections
SEE-ME

A STEM Educational Experience in Modeling the Earth System

- A web-based, interactive educational tool and resources
- Exploring clouds, weather, climate, and modeling
- Targeting grades 9 - 12, teachers, and the public
- Informed by sound pedagogy and scientific research
- Disseminated on Windows to the Universe web site
- MMAP providing a new focus for our EO mission
• Spans the Earth and space sciences, with arts and humanities connections
• Integrated classroom activities, interactives, and models
• Largest education and outreach venue at NCAR/UCAR, with over 5 million visitors since last October (~43 million page views)
  - ~65% K-12 students, 25% in Spanish
Partnership with Public Schools

- UCAR “levelizer” concept
- Web-based dissemination tools (Windows, SEE-ME) developed with teacher involvement at Rocky Mountain High School
- Collaboration with CSU Psychology Dept (Prof. S. Canetto and students)
- Material to be used in AP Environmental Science an Introduction to Earth Science, with student feedback
- Assessment study at CSU Sociology (Prof. M. Lacy and students)
Obj 4: Climate Stakeholders and Policymakers

• Colorado Institute for Public Policy (CIPP), Dr. Lyn Kathlene, Director
• Convene 6-month working groups of scientists and stakeholders to produce “white papers” on climate and impacts with local-regional focus (e.g., water, farming)
• Conduct educational “hands-on” workshops for policy makers and the public
• Teach short course on policy process for MMAP graduate students
Obj 5: Undergraduate Education

- Academic content in climate courses developed and tested at Colorado College (Prof. H. Drossman)
- Internships for MMAP grad students to teach these courses (block structure)
- Evaluation in classroom and through student achievement
- Dissemination of results through national pedagogical media
Obj 6: Graduate Education & Research

- The core of ED in MMAP
- 19 grad students at 5 institutions
- A diverse pool (HU, SOARS, AGEP, scholarships), 6 to 8 from underrepresented groups
- Cutting edge climate research in leading universities
- A new focus on pedagogy for graduate students in top research programs
- Very strong record of placement on climate faculties worldwide
Obj 7: Scientists as Good Teachers

- Pedagogical study as part of MMAP graduate study
- MMAP students work with Drossman to develop & teach at CC
- MMAP students develop and teach content in teacher training courses
- CSU undergrads work as LSOP interns
Diversity Mission

Increase the number of women and underrepresented minorities in climate science by aggressively recruiting these groups as MMAP grad students, helping them become excellent scientists and educators, and placing them in leadership faculty positions. Enhance the science and engineering pipeline through mentoring and recruiting at earlier academic levels. Study diversity problems and solutions, and disseminate results.
Diversity Goals

• Support and matriculate graduate students whose gender and ethnic makeup reflect those of the US population
• Improve understanding of the structural barriers to gender and ethnic balance in science
• Encourage participation in science and engineering by women and minorities at all academic levels
## Diversity Objectives

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<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Recruit and matriculate representative Ph.D. students from MMAP</td>
<td>2 Ph.D. students at HU</td>
<td>Denning ED coord</td>
<td>HU</td>
<td>Ongoing</td>
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<td></td>
<td>2 grad students and 3 summer interns per year through SOARS</td>
<td>Pandja</td>
<td>UCAR</td>
<td>Ongoing</td>
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<td></td>
<td>3 summer internships for HU undergrads</td>
<td>El-Hakim</td>
<td>HU</td>
<td>Ongoing</td>
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<tr>
<td></td>
<td>2 CSU minority scholarships in ATS</td>
<td></td>
<td>CSU</td>
<td>Ongoing</td>
</tr>
<tr>
<td>Improved recruitment of ethnic minorities to undergraduate science and engineering programs</td>
<td>Present climate science to 400 minority high school students per year through CO-AMP and Drossman</td>
<td>Denning ED coord, El-Hakim, Drossman</td>
<td>CSU, CSU, Catamount Institute</td>
<td>Ongoing</td>
</tr>
<tr>
<td>Better retention of women in the science pipeline</td>
<td>Mentoring program pairing female ATS grad students with female high-school students</td>
<td>Denning ED coord</td>
<td>CSU, CSU</td>
<td>Ongoing</td>
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<td></td>
<td>Women in LSOP</td>
<td>Jones Canetto</td>
<td>CSU, CSU</td>
<td>Ongoing</td>
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<tr>
<td>Study diversity problems and solutions, and disseminate results</td>
<td>Study of media portrayal of gender in science</td>
<td>Denning Canetto, McPhee ED coord</td>
<td>CSU, CSU</td>
<td>Ongoing</td>
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<td></td>
<td>Longitudinal study of women in science careers</td>
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<td>CSU, CSU</td>
<td>Ongoing</td>
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<td></td>
<td>Assessment of McNair mentoring program</td>
<td></td>
<td>CSU, CSU</td>
<td>Ongoing</td>
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</tbody>
</table>
Obj 1 & 2: Academic Bridges

- High school to undergraduate bridge (CO-AMP, Catamount Institute)
  - Residential program recruits 400 students/year from underrepresented groups
  - Introduction to STEM opportunities and CSU community
  - Urban youth engaged in climate science as part of larger environmental program

- Undergraduate to graduate bridge (SOARS, AGEP)
  - Residential summer research internships
  - Community support
  - Graduate student research assistantships
Young Environmental Stewards Programs

- Science
- Technology
- Leadership
Obj 3: Women in Science Pipeline

- Mentoring program pairs women graduate students with female high school students, to model success
- Women as LSOP interns
Obj 4: Understanding the Barriers

MMAP Research on Diversity

- Gender and Science in Media (Canetto)
- Longitudinal study of barriers and successes for women in science careers (Canetto)
- Assessment of McNair mentoring program (McPhee)
Metrics for Edu Objectives 1 & 2

- Number of new curriculum kits and DVD sets developed through LSOP and tested in PSD classrooms
- Number of science teachers trained through CSU course
- Number, duration, and quality of visits to Windows to Universe and SEE-ME web tools
- Formal assessment of classroom effectiveness and student performance, with publication of findings through national conferences and peer-reviewed journals

See draft plan for metrics broken out by objective
Metrics for Diversity Objective 1

- Number of women and underrepresented minority students supported by MMAP, and comparison to demographic data
- Number of SOARS protégés placed in PhD programs
- Number of MMAP-supported women and minority PhDs obtaining faculty positions

See draft plan for metrics broken out by objective
Management Structure in ED

Education and Diversity elements of STC are managed as a single package

• Assoc. Director for ED serves on Executive Committee
• Full-time ED Coordinator manages day-to-day operations in collaboration with other STC administrative staff
• ED Committee provides oversight, and engages scientific talent through rotation
ED Coordinator

• Works with the Center Administrative Director and ED partners to track performance of component activities
• Organizes twice yearly progress reports from EOD partners
• Manages communications among ED partners, and between MMAP scientists and ED resources
• Organizes monthly telecoms among ED partners and management
• Organizes and schedules ED component of twice-annual MMAP meetings